Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

BERGSON AND SCIENCE.

THE most casual reader of Bergson would gain the impression that he is under some obligation to science. Strangely enough the opinion appears to be general that science in turn owes nothing to Bergson. To most actions in the world there is a reaction, and there is also some kind of mutuality in most human relations. Science may possibly have something to learn from a great modern philosophy such as that of Bergson.

A universe that is in eternal flux has little place for finality, and finality is the bane of science. If a great industry wishes to carry out a practical research, the difficulty is to find men whose minds are not hopelessly closed by the sense of the finality of their present knowledge. The more elaborate their education often the more hopelessly rigid are their ideas. Every advance of science has to contend, not only with the natural difficulties of a great problem, but also with the ideas of scientific men. As we look back on the history of science, we are slow to admit that the movement has been anything but a steady advance from small beginnings to the present goal. First was the chemical atom. Then the chemical atom was broken up into the smaller atoms—the electrons. That was merely an advance, a progress. The atom of Dalton is still with us. Yes, but this takes no account of the idea of finality that was once attached to the old atom, nor to the prejudice that such finality created in the minds of those who were called upon to contemplate the possibility of that atom's divisibility. Newtonian ideas of gravitation survived the disruption by Faraday of the idea of action at a distance. The achievements of Newton and Laplace have not been disturbed by those of Faraday. But the statement conveys no suspicion of the fact that had Faraday been well trained in the physics of the eighteenth century he, perhaps, would not have had the courage to act upon his own ideas.

The sense of finality is very persistent and stands in the way of growing knowledge. If we think of present knowledge as a mass surrounded by the boundless space of nescience, we may imagine growth taking place by some kind of addition coming to the surface. But science grows not as a stone by increasing size through mere mechanical addition. It grows more as an organism would. The most apparently insignificant accretion may profoundly change the whole character of the mass of hitherto acquired knowledge. It may help scientific men if they consciously realize that all is a flux, that change is the fundamental nature of reality, and that if we once see things as they are we shall say there is nothing but change, pure mobility. Perhaps the useless, stubborn, obstructing element of human conservatism requires just such drastic treatment.

Science has indeed played sad havoc with the finality of human concepts. A concept is enriched by some experience and soon it acquires a new extension of the intellectual grounds covered by it. Magellan's circumnavigation of the globe gave the concepts 'up' and 'down' a new meaning and an extension of that of 'gravitation' to the motion of the moon in its orbit. Embryology and paleontology so profoundly changed the concept 'species,' introducing continuity into the conceptual realm of biology, as indeed to throw this whole concept into an almost hopeless flux, rendering it incapable of definition. The physical concept of 'mass' is yielding to the modern idea that it is a function of the movement of a body's lines of force extending into boundless space.

In Bergson the concepts take on a new extension and new content. 'Life,' 'Materiality,' 'the self,' 'duration,' and many more on Bergson's pages convey meanings they never had before. It is the nature of philosophical and scientific progress to keep their concepts in a flux. This is true because of the nature of the world in which we live and because of the character of our concepts. The mind approaches reality with certain concepts because they satisfy a human need, give humanity control of reality. The superiority of one system of concepts over another will be determined by their superior capacity for increasing human power. The eternal flux of concepts points to the unlimited capacity of nature to respond to the needs of men. *Science made* will always assume an air of finality, presenting a logically completed system. From the ever-growing needs of men will come ideas changing the boundaries and content of the concepts of science, disintegrating the old scientific structure and building it anew. The difficulty is that the finalists always possess an advantage and their use of it is shamelessly detrimental to progress. The new ideas can never at first justify themselves. Their origin discredits them. They spring from the domain not of the intellect but of the intuition. Their origin is often very plebeian, more than plebeian. For in the matter of intuition it is believed by some that bees and wasps have a decided advantage over men. But, be that as it may, science in the making comes from the realms of intuition. Out of this fact comes the need on the part of scientific men for some kind of philosophy of intuition. If we are to exercise any conscious control over the advance of science, we need at least to respect, if we cannot understand, the source of new concepts. There can be little doubt that they have an origin outside the domain commonly assigned to the intellect. The most fertile concept in modern physics is that of energy. It was very late in finding its way into science. The intuition of the workers of the world long ago found it. The concept of work expressed that which they gave the world and that which in turn the world valued. The intuition of work, of energy, was involved in the efforts of that endless line of seekers for perpetual motion. But into physics the concept never entered fruitfully until Helmholz tried to explain to his own mind why these seekers for perpetual motion had universally failed in their quest. The latter must involve a violation of some great law of nature. In the effort of these generations of unsuccessful seekers was contained an intuition of the concept of energy which in Helmholz's hands proved so fruitful in multiplying the power of physical science. Bergson expresses the fundamental nature of the quest for a new concept as follows: "In order to generalize we have to abstract similarity, but, in order to disengage similarity usefully we must already know how to generalize."[1] This simply means that intellect alone cannot generalize. Intuition cuts the knot. We search the continuum that is reality for that which will satisfy our need. We take that satisfaction where we find it. In this part of the process of forming concepts the lower animals may possess an advantage over us. The coyote who loves kidney fat does not perceive other qualities in the animal in which he finds it. He is simply looking for kidney fat. He 'lives generality.' He does not think it. We too must live it before we shall ever think it. Out of the life of the world spring the concepts which enrich science. These concepts come to science through the intuition of genius. And often, as in the case of the concept of energy, it is the genius of humanity. Nothing can be more grotesque than to demand of scientific ideas a proof of their fertility at their first appearance. Before their final acceptance they will have undergone the most rigorous testing. We are not overburdened with ideas. The world has always suffered from a poverty of them. Science is not all a patient collecting of facts. That alone would never give the smallest advance. The epochs in science have been marked by the advent of new concepts springing from the depths of human intuition.

---

[1] *Matter and Memory*, p. 208.

The other form of finality against which science has had to contend has been a foe in her own camp. Before the days of the researches in radioactivity some physicists believed that the great laws of nature had all been discovered. The discoveries of the future would be in the 'sixth decimal place.' There was nothing to look forward to but greater precision in the statement of laws already discovered. Behind the scenes in our phenomenal world, explaining all its activities, was a perfectly definite mechanical system of atoms and molecules, which predetermined all the events of the material world with scientific exactness. A materialistic philosophy had been built upon this view of the physicist. All the events of the world for ages to come were predetermined by the present state of this atomic and molecular machinery. The revelations of radioactivity set the date of a renaissance in the activities of physicists. The atomic and molecular mechanism suddenly became very complicated. The atom, formerly supposed simple, became a universe in itself.

If a chance discovery in one small department of physical research can so complicate the 'scheme of things,' what assurance can we have that the mechanism lying back of nature's scenes is not infinitely complex, that anyone of a number of phases of that infinite complexity might have been discovered first? It seems absurd to think that the scheme could have been unravelled only in one way. Nature, infinitely complex, could respond to any one of many modes of approach. The course of evolution of science was not predetermined by the nature of science herself already existing in nature, awaiting discovery. The history of science began to assume some significance. Science had hitherto been its own history. Consider the logical form of the completed scientific structure. There in its very logical nature you had the one and only possible story of its evolution. But for a nature explained by a mechanism of infinite complexity there could be as many sciences as genius could suggest ways of approach. Now add to this the idea that these ways of approach spring from human intuition, that each method of approach comes from something unique in the personality of a Faraday, say, then the work of science becomes creative like music and art, and the history of science is determined by the personality of its great masters. Mach, long ago, in his *History of Mechanics*, called attention to the influence exercised upon the course of science by the personality of men. If Faraday had not been possessed of his peculiar intuition of the fundamental character of physical action and reaction, electromagnetic induction would not have been discovered when it was, and the discovery of the law of the conservation of energy would have been much delayed. The course of the history of nineteenth century physical science would have been greatly changed. We cannot think that someone sooner or later would not have discovered electromagnetic induction. Yet we may easily imagine that, without Faraday's intuition regarding the impossibility of action at a distance, the course of investigation and discovery that led through Maxwell to electromagnetic waves and wireless telegraphy might have been delayed a century or so.

Creativeness cannot be described nor its work understood in intellectual terms. But this does not afford the slightest reason for ignoring its existence. In another field, it looks as though science would be compelled to acknowledge the presence and activity of a creative power—in the evolution of the forms of life. Evolutionists have never been able to give an adequate explanation of the development of a complex organ like the eye. The method of science is to analyze the eye into elements. Now each of these elements must be brought into existence, made a permanent possession, by natural selection. They must be assembled and coördinated. The difficulty is to see how the assemblage of elements can possess survival value at each stage of that evolution. Natural selection could not have preserved a single one of those elements of the functions of seeing without the presence of coördinate elements that make it effective. The great creative force in nature must proceed in some way quite different from that suggested by human logic. Man's mind is only one of the remote tips of one of the upper branches of the tree life, and is of itself unable to explain the processes going on in the trunk.

The creative activity in nature has much in common with that working in the evolution of human science. A fertile idea has survival value from the start. The discovery of Oersted suggested to Faraday the idea of the procedure that led to his discovery of electromagnetic induction. But the idea working in his mind was larger than that of this one impending discovery. His intuition held the germ of the law of conservation of energy. In the intuition that led Faraday in those years and in the discovery in which it found expression was the complete function of what is now known as the electrical transmission of energy. The whole science of electrical engineering is simply that of this one function, viz., the force acting upon a wire carrying a current in a magnetic field—expressing itself in evermore complicated forms. The whole science of electrical engineering was in the intuition that carried Faraday through those years spent in the search for electromagnetic induction. This fundamental function in electrical engineering science possessed survival value at every stage of its evolution, from the vaguest outline of it in

Faraday's physical instincts to the complicated modern power plant. May it not be true that at every stage in the evolution of a complex organ like the eye it possessed survival value, not because it gave expression to what we now call seeing, but to some function, the forerunner of seeing, useful for purposes of survival. Side by side with the evolution such as we would have seen looking at it from the outside and describing it in terms of a mechanical assemblage of the elements to be found only in the perfected organ, was another evolution moving parallel to the first, the evolution of a consciousness, the last expression of which is vision as we now know it. The same thing may be said of the whole of materiality, the whole of our science. No assemblage of mechanical elements will give us a real whole. Each new fact or law of science stands where once was an apparently insurmountable obstacle to an advancement much larger than that particular fact or law. "Everything happens as though the grip of intelligence on matter were, in its main intention, to *let something pass* that matter is holding back."[1] Just before every advance materiality is standing in the way of a movement of the human spirit. All the energy of the spirit is summoned to overcome the obstacle. "The materiality of the machine does not represent a sum of means employed, but a sum of obstacles avoided; it is a negation rather than a positive reality."[2] The whole of our perceptual world is but a small part of reality on this view. The great thing to be considered is that the perceptual, the scientific, the materialistic is not isolable, but maintains the most intimate relationship with a greater reality that will not be made subject to the categories of the mind. In the process of scientific discovery this greater reality is constantly manifesting itself. The problem of the investigator is stated in perceptual terms. The method of attack is in such terms. But the solution comes through something more than a merely logical activity. It is profoundly intuitive. All the perceptual elements of the problem seem to pass into the inner life of the discoverer. Poincaré has described the process of mathematical discovery. The perceptual elements of the problem are first considered in conscious intellectual activity, where everything assumes a logical form. Strenuous effort is made to effect a solution. This conscious effort fails. After a long season of rest, suddenly, without warning, an attitude that must lead to a successful solution comes up into consciousness. Some would explain the result as the outcome of a subconscious mental activity. This is simply to insist on imposing the logical activities of the conscious mind upon the profounder functions of our nature. The hypothesis of subconscious mental activity is made in the interests of maintaining intellectual activity as the only possible form of rationality. If we knew more we should seek to derive our conscious intellectual activities from the more fundamental ones.

---

[1] *Creative Evolution*, p. 183.

[2] *Ibid.*, p. 93.

One of the most startling facts concerning human nature revealed by the slightest introspection is this,—of what a very minute portion of our world are we distinctly conscious at any one moment. At any given instant how many of the significant persons and things in life are out of mind. A football player attempting to stop an opponent carrying the ball is absorbed in the momentary action. How much even of the present game is he, at this moment, forgetting. He is not distinctly conscious of the score up to the present instant. The goal is not pictured in his mind. He has probably no visual image of the people in the grandstand. How very much of the game he is playing is out of the player's mind, to say nothing of the countless motives that have had their part in bringing this player into the field. While these things are all out of mind they are not outside the player's being. While he is not distinctly recalling the score, the quality of his present attitude is very accurately determined by it. While he does not in his moment of absorption picture the goal, that goal is directing his present action. Should the spectator on the side lines be withdrawn, something would be taken from the character of his immediate performance. There is in his instantaneous attitude a certain quality that would not be there were it not for the friend who is now far away but who will read a report of the game. When we are absorbed in any given action only a minute portion of our experience is distinctly figured in its visual outline. But in our attitude are the great purposes of life and the countless things that give us our motives. All our world, at any given instant, lying outside our distinct image of reality, is nevertheless acting in us. It is all there blending into one attitude, one purpose, one special motive, like many tones blending into a single harmony. External phenomena have all entered into a kind of chemical combination with one another, while the separate elements of the combination have lost the individual properties that they possess in the distinct form of consciousness. There is a definite unity in our momentary action, our attitude. The diverse elements of persons and things which blend into the single attitude have lost their individual identity. But they have not passed into a mythical realm of the unconscious. They have become one unified attitude, which will on the slightest hint break up into the diversified elements distinctly visualized. There is a continuity between these two forms of consciousness as they pass the one into the other, this unity passing into multiplicity which breaks in upon that unity with as little surprise as when we awaken to a sense of the presence of a friend in the same room with us after our absorption in a book. The return of a sense of the friend's presence is not like one coming from the dead, for the friend has been in our active mental attitude all the time, no matter how deep the absorption. We know that in some remarkable way the multiplicity of persons and things with which that unity breaks up was with us all the time. This describes one of Bergson's fluxes. The human spirit moves from the realm of this unity, the intuitive, where being and knowing are one, the realm of the uncategorized, the personal, where everything interpenetrates everything else, the realm where we possess only activities and attitudes, where consciousness is qualitative, to the realm of multiplicity, spatiality, where impenetrability is the universal law, the categorized, the logical, the perceptual, the impersonal, the realm of science. Here is a movement that gives rise to the great dualisms in human thought. In the place of these dualisms Bergson substitutes a creative movement. When the ends of the movement are considered the dualism is absolute. For the riddle of the dualism Bergson would substitute the riddle of creation. But it is to be a creation with an order in it. The great dualism at the beginning and at the end of the movement is to be bridged by the movement itself characterized by a perfect continuity. In a continuous movement of this kind there should be any number of possible points of arrest. The movement in our own consciousness has been made possible by the whole history of our evolution, and evolution is known to cover up its tracks, to erase its continuities. To find as many points of arrest as possible then is desirable in maintaining the hypothesis of such a movement. We can not arrest it at any point we choose. Yet in the great world outside us Bergson finds a similar movement. In it we may distinguish stages. "The movement at the end of which is spatiality lays down along its course the faculty of induction as well as that of deduction, in fact, intellectuality entire."[1] Logical induction and deduction then are points of arrest in this movement. Beyond these points of arrest lie the limits of the movement, spatiality. Other points of arrest are indicated. This is the movement of the supra-consciousness. He says: "Consciousness or supra-consciousness is the name for the rocket whose extinguished fragments fall back as matter; consciousness, again, is the name for that which subsists of the rocket itself passing through the fragment and lighting them up into organisms."[2] This movement of the supra-consciousness is parallel to the above described movement of the human mind. It is this movement of the supra-consciousness that has laid down deduction and induction on its way to spatiality, and which "creates at once the intellectuality of mind and the materiality of matter." But in this movement the supra-consciousness does not go so far into spatiality as does the human mind. The latter has followed the movement of matter towards spatiality but has gone farther and become more spatial than matter is. For modern physics shows that in reality matter interpenetrates. The human mind on the other hand breaks up matter into distinct bodies. This movement is creative, each moment of it shows something unique, something that is an epigenesis upon all that went before. The movement creates matter, it creates intellect, logical powers and spatiality. The creations are real and absolute. One end of the movement materiality, intellectuality, spatiality, is just as real as the other end which is life, intuition, interpenetration. At the one end we have that which constitutes a scientific order, where prediction is possible. But the movement that creates the scientific order, the movement that is forever re-creating it, is not a scientific order. It is an order such as is exemplified in "a Beethoven symphony which is genius, originality, and therefore unforeseeability itself."[1] These two orders are two forms of rationality that reign over reality. In the scientific realm we have the one form. In the realm of life and intuition we have another form, an æsthetic one, the kind of rationality that is found in a Beethoven symphony. This is giving to rationality a new meaning but we have need of a concept that will cover the whole ground. The movement symbolized by a Beethoven symphony is certainly different in character from any physical movement we know. According to Bergson's theories, it is unique in each moment of it. Each moment of it is something new created, each moment of it presents a difference of kind. Yet the movement is a perfectly continuous one. The total movement results in an accumulation of differences of kind that amount to an absolute dualism when the beginning and the end of the movement are compared. Yet throughout it all a continuity prevails. This is not a movement such as that of a point describing a line, not a movement of spatial changes, but one of qualitative changes. The successive moments of the movement are unpredictable from anything that precedes, like the next step in a curve that is determined by an infinite number of derivatives of successive orders, yet like the next step in the curve, continuous with what went before. This is certainly a new kind of continuity, a qualitative one, but we do to some extent intuitively sense it. If we could re-live the life of the race in the evolution of the human consciousness from instinct to intelligence, we might feel and realize its perfect continuity and its perfectly creative character. To make this a working hypothesis it is not necessary to re-live history and to experience the continuity any more than the finding of the missing link is necessary to the theory of Darwinian evolution.

---

[1] *Creative Evolution*, p. 216.

[2] *Ibid.*, p. 261.

---

[1] *Op. cit.*, p. 224.

If we grant that a movement may be continuous and yet each moment of it have in it something uniquely different in kind from what went before, there is no additional difficulty in understanding how in the process of that movement the human consciousness might create itself into an identity with something which was external to itself in another phase of its being. To make such an action possible, the supra-consciousness and the individual consciousness must interpenetrate, must have much in common. "Intellect and matter have progressively adapted themselves one to the other in order to attain at last a common form. This adaptation has, moreover, been brought about quite naturally, because it is the same inversion of the same movement which creates at once the intellectuality of mind and the materiality of things."[1] In some such way as this we may understand Bergson's claim to occupy a place above both realism and idealism and embracing both.

The order of that movement that starts in the realm where being and knowing are one is the order of a Beethoven symphony, but a Beethoven symphony which is repeated many times in our lives. Each moment of that movement is unpredictable from anything in the preceding moment. Yet from habit we know what to expect, as we do in hearing the great musical composition for the fiftieth time. Thus it is that a certain quality, a certain tone in the inner intuitive life, is always issuing into an outer creation of a character quite definitely related to the inner. In other words there is a definite psycho-physical parallelism between the inner, the personal, the intuitive and the outer, the spatialized, the materialized world; between the order of the Beethoven symphony and the scientific order. The inner intuitive life is the self and the other is the objective world. Bergson's psycho-physical parallelism is not between the physical organism of the individual, and his psychical life, but between the inner personal life and all outer reality, something of which the human body is but a small part. The parallelism between the two explains Hume's difficulties in his efforts to find the self. "I never catch myself at any time without a perception and never can observe anything but the perception." So completely did Hume find the outer world identified with the self that he doubted the existence of the latter. When Hume, looking for himself, found only a perception, the self had reached the terminus of a movement where it had actually created itself into an outer reality. All he had to do was to stop looking for anything, even the self, and the inverse movement would carry him back into the realm of intuition where the overwhelming sense of self is asserted. The moment that the self tries to picture itself, to give itself form, it moves out into the realm of spatiality where only perceptions are experienced. We know we have a self as long as we do not try to find it. We lose it the moment we look for it. The inner life, the life of intuition, is the self. The creative movement is the expression of the creative effort of the self. At the inner terminus of the movement the self is one with all its past, perhaps one with all reality. Interpenetration is the great fact here. At the outer terminus of the movement is perception, and there the self is at one with as much of a reality as interests it.

---

[1] *Op. cit.*, p. 206.

Each execution of the movement from inner to outer is much the same, like the great symphony played for the hundredth time. But it is a creative movement, each repetition is never quite the same. The movement itself is in flux. The outer reality is in flux. All the movements are creative. Nature is ever being made anew and always changing. We too are ever changing. The question naturally arises: If nature's inmost reality is changed, where is science possible? Science deals with constancies. Change permeates our world to its inmost core. We may trace a curve with a certain degree of approximation if we know its mathematical law. That is, if we know the derivative of a certain number of low orders of a function, say the first, second and third, provided the derivatives of the higher orders approach constancy over a certain short course of the curve.

But if all the derivatives of the higher orders to infinity are variables, and each derivative a new function, the whole movement of our curve is change of the profoundest kind. Prediction of its course becomes impossible. Likewise it becomes impossible to isolate a something, an unchanging somewhat, of which we may say it is, putting into the 'is' the sense that the something endures unchanged for an appreciable time. This would be the aspect of reality to us if the span of our duration should be indefinitely lengthened. By shortening this span of duration all the higher derivatives of the function approach constancy during the course the curve takes in that short span of duration, and we progress toward a view of reality in which changes are momentarily, at least, inappreciable. Here science finds its province. Here it can trace with some degree of approximation future movements of the curve. Its work is thus relative to the particular span of our duration. But even with this limited span of duration all would still appear changed were it not for the coarseness of our senses which do not detect the incessant change really going on. In the domain of life, of mental life, of psychology, the change is more in evidence and in these fields science must meet some of the difficulties it would experience in the realm of matter itself were the span of our duration considerably lengthened. In such a lengthened span of duration we would say there is nothing but change. We could not say that it is nothing that changes, for the idea of a nothing would itself be inconceivable. Nothing is a negation of something. The idea of something appears only on the indefinite shortening of the 'rhythm of our duration.' When that rhythm is lengthened to an unlimited extent, or when our senses should become unlimitedly appreciative of all changes, no matter how minute, all idea of a something would disappear together with its negative nothing, and the only reality would be change, pure mobility. Science finds its province by carefully defining, stating and respecting its relations to this mobility. Science exists for beings of a shortened duration, of coarse senses, and in fields where apparently unchanging somethings may be isolated. The work of science is never a finality. However, its work is a part of reality. It is a reality created by the never ending movement of life, and of individual minds which spring from the great life movement. It is a reality in flux. The scientific order occupies for us the commanding position in all the fluxes that constitute reality. As the spirit moves from inner to outer and back, ever enriching and enlarging itself, the scientific order, the perceptual order, is the one cross-section of the whole movement at which we can control everything. The perceptual life gives the intuition its material. The manipulations we attempt in the scientific order are the challenges to intuition to its creative effort. "There are things which intelligence alone is able to seek, but which, by itself, it will never find. These things instinct alone could find; but it would never seek them."[1] Between the two orders of rationality is a remarkable parallelism, a most intimate interrelationship. The scientific order owes its existence to the creative movement of the other order, and it depends upon it for its health and its vitality, and its never ending process of re-creation.

The order typified by the Beethoven symphony must be respected in every process involving growth. Scientific concepts are made and grasped through intuition. Every act of the human being is a creative one, originating in instinct, in intuition and seeking objective expression. Every single act of this kind is only a part of a larger act that is seeking expression, in other words, every creative act is the part of a creative purpose born in the fundamental instincts, the intuition of the personality. These acts and their larger purposes have survival value for the individual; otherwise they would never express themselves. No matter what complex idea may be in the process of being grasped, that part of it that is possessed at any moment must have survival value. There is no such thing as learning the separate elements of a great principle or anything else, each element one at a time, and later assembling them into a whole by a purely mechanical process. The human mind does not work that way. It grasps things by wholes. It dissociates the wholes into elements, but it never assembles mechanical elements into a whole. The first beginnings of understanding the law of the conservation of energy can be made by a mind that has already enough of that law in intuition to give it survival value for that mind. This survival value comes from the fact that any given act of understanding is part of the larger act, a purpose, yes, a life purpose. The mind acts creatively along lines that associate its special act with life purposes. Every element of a scientific education, whenever we look at it in a partially completed state, must represent what was once an obstacle to the instinctive movements of the whole personality. To this end educational material should not be organized out of the abstract elements into which logical analysis divides it up, but it should be organized into a hierarchy of purposes having an appeal to the instincts of human beings. The world's scientific achievements should appeal to the learner as a system of problems out of which purposes spring, organize themselves, and come to fuller expression. Our courses of instruction should be alive with the spirit of research. But they should present that spirit not alone in terms of its final product but in its origin, in the instincts and the intuitions of the mind. We are very ineffective in our attempts to pass our scientific heritage along to coming generations.

---

[1] *Op. cit.*, p. 151.

The current ideas of genius are most unscientific. Genius makes its contributions to science through intuition. In all phenomena the principle of continuity reigns. But not so with the prevailing ideas concerning genius. Find a quality that is possessed in a striking way by one object, one may be sure that all objects possess that quality in a degree. All men possess some genius and it is a positive, worth-while asset. The education of every human being must come forth out of his own personality, must be his own personal creation. To facilitate individual effort towards education, the achievements of the race should not make the appeal of a museum with its classified fossils, or of an encyclopedia or even of a textbook with knowledge de-organized, mechanized on some logical scheme. But if human achievement in science is presented in terms of a possible system of organized human purposes, the personality feels the appeal of something it can assimilate. The individual's education must be an expression of his growing personality, fed by the achievement of the race organized into ends that appeal. The material is in most intimate relationship with the largest spiritual reality. Our interests should be largely in *science in the making* rather than in *science made.* Human genius, human personality even in its most humble form, is an asset of scientific worth. All our power of controlling our world comes from the attempted application of scientific concepts to reality. Bergson is regarded by some as an anti-intellectualist. His whole effort, however, is to apply intellectual procedure to the mastery of the whole spiritual reality. His philosophy represents not a restriction but an extension of intellectual effort. As the mathematician takes that piece of incomprehensibility, the square root of minus one, and operates upon it in a perfectly comprehensible way and obtains useful results, so Bergson seeks to apply intellectual methods to incomprehensible intuition and thus to gain some control over this undoubted faculty. In the light of these ideas science is the pursuit of power, power in controlling our world. The history of science is the history of the growth of human power over the forces and energies of nature, not the discovery of a truth hidden in nature waiting to be found. Scientific and philosophic education is the evolution of the individual's sense of power, the expression of his personality.

The universe is one of order. But there are two kinds of order. The materialistic order is the field of science. The other order typified by the Beethoven symphony is the field of metaphysics. The close interrelationship of these two orders brings science and metaphysics into very close fellowship. Sometimes "science, theory of knowledge, and metaphysics find themselves on the same ground."[1] In such close relationship there is no need of substituting metaphysical explanation of phenomena for scientific. The determination to push scientific explanations just as far as they can be possibly pushed must be persisted in at all hazards. For example, when, in discussing instinct, Bergson speaks of "sympathy between the amophila and its victim"[2] the idea of sympathy meeting a metaphysical need is not used to the end of finally closing the scientific problem involved in the study of instinct.

---

[1] *Op. cit.*, p. 198.

[2] *Ibid.*, p. 173.

The modern scientific movement is a new force in human affairs. Repeated attempts have been made to understand its meaning and nature, the real essence of scientific method. We naturally like to reach some kind of an intelligent consciousness of what we are doing. An early attempt in modern times to attain such a consciousness was Bacon's *Novum Organon.* No one would today claim that attempt was wholly adequate. Other attempts followed Bacon's. It is entirely possible that modern philosophies like Bergson's may help us to a clearer consciousness of the real aim and character of natural science.

LEWIS ELLSWORTH AKELEY.

UNIVERSITY OF SOUTH DAKOTA.